

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants: B.T. Tolton et al. Attorney Docket No.: LAMA122586
Application No.: 10/799,444 Art Unit: 2884 / Confirmation No.: 6250
Filed: March 12, 2004 Examiner: D. Malevic
Title: REMOTE SENSING OF GAS LEAKS

APPELLANTS' AMENDED APPEAL BRIEF

Seattle, Washington
March 11, 2008

TO THE COMMISSIONER FOR PATENTS:

This amended Appeal Brief is responsive to the Notification of Non-Compliant Appeal Brief mailed February 14, 2008, and is filed in support of the Notice of Appeal filed November 21, 2007, appealing the Examiner's final rejection dated June 5, 2007, of pending Claims 1-18 and 20-25. As per the Notification of Non-Compliant Appeal Brief, references to canceled Claim 26 have been removed from the Grounds of Rejection and Argument sections of the Appeal Brief.

In the final Office Action, Claims 1, 2, 5, 7, 11, 12, 13, 15, and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. (U.S. Patent No. 6,750,453) in view of Griggs et al. (U.S. Patent No. 4,520,265). Claims 3 and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of Hodgkinson (International Publication No. WO 01/94916). Claims 4 and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of subject matter alleged to be old and well known. Claims 6, 10, 14, 18, 20, 24 and 25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of French (U.S. Patent No. 4,676,642). Claim 17 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. in view of Smith et al. (U.S. Patent No. 6,756,592). Claims 21, 22 and 23 were rejected under 35 U.S.C. § 103(a) as being

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CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

unpatentable over Nelson et al. in view of French and Hodgkinson. Claim 1 was further rejected under 35 U.S.C. § 102(b) as being anticipated by Zwick (U.S. Patent No. 4,543,481), while Claim 2 was further rejected under 35 U.S.C. § 103(a) as being unpatentable over Zwick and Griggs in view of Hodgkinson.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

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I. REAL PARTY IN INTEREST

The assignee, Synodon Inc., is the real party in interest, by way of an assignment recorded on July 26, 2004 at Reel 014902, Frame 0888.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

III. STATUS OF CLAIMS

Claims 19 and 26-31 have been canceled. Claims 1-18 and 20-25 have been finally rejected, and it is these rejections that are being appealed.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

IV. STATUS OF AMENDMENTS

An amendment after final was filed August 6, 2007 with proposed amendments to Claims 5, 6 and 18, and a proposed new Claim 32. However, these amendments were not entered.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

V. SUMMARY OF CLAIMED SUBJECT MATTER

Of the claims at issue, Claims 1, 18 and 21 are independent claims. Claims 2-17 depend directly or indirectly from Claim 1, Claims 20 and 24 depend directly or indirectly from Claim 18, and Claims 22 and 23 depend from Claim 21. In the summary below, the paragraph numbers refer to the numbered paragraphs in the application as filed.

Claim 1 refers to a method of detecting gas leaks. A target area 354 (paragraph 24) is traversed with a gas filter correlation radiometer 101 (paragraphs 17 and 18) having a field of view 352 (paragraph 24) oriented towards the target area 354. The gas filter correlation radiometer 101 is tuned to detect ethane (paragraph 18). A gas leak 356 (paragraph 24) is identified upon the gas filter correlation radiometer 101 detecting the presence of ethane 358 (paragraph 24) by detecting variations in solar radiation reflected from the target area 354.

Claim 2 and 3 refers to the GFCR being tuned to detect ethane using an ethane absorption peak at 3000 cm^{-1} (see paragraphs 7 and 18). Claims 3 and 8 refer to the GFCR being tuned to detect ethane using an ethane absorption peak a bandwidth of $2850\text{ to }3075\text{ cm}^{-1}$ (see paragraphs 8 and 18). Claims 4 and 9 refer to the GFCR being tuned to detect ethane using an ethane absorption peak at a bandwidth up to 150 cm^{-1} above or below 3000 cm^{-1} (see paragraph 9). Claim 6 refers to the method of Claim 1 using a GFCR similar to the GFCR claimed in Claim 21 and described below, but without specifying the bandwidth the GFCR is tuned to detect.

Claims 18 and 21 refer to a gas filter correlation radiometer 101 (GFCR - paragraphs 17 and 18). The GFCR has a window 103 in a housing 100 (paragraph 18). Optics 124, 116, 122 (paragraph 18) define a first optical path 110 and a second optical path 112 between the window 103 and a detector section 102A, 102B mounted in the housing 100 (paragraph 18). A bi-prism beam splitter 106 (in Claim 18) or a beam splitter 106 (in Claim 21) is mounted in the housing 100 as part of the optics for directing radiation entering the window 103 from an outside source along two divergent paths offset from each other through the prism or bi-prism to divide the radiation between the first optical path 110 and the second optical path 112 (paragraph 19). The first optical path 110 has a first gas path length and the second optical path 112 has a second gas

path length. The first gas path length is different from the second gas path length (paragraph 19). There are electronics 108 for processing signals produced by the detector section as a result of radiation being directed by the optics onto the detector section (paragraph 19). In Claim 21, the GFCR 101 is tuned to detect ethane using an ethane absorption peak at a bandwidth of at least 2850 to 3075 cm^{-1} (paragraphs 8 and 18).

VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 2, 5, 7, 11, 12, 13, 15, and 16 currently stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson et al. (U.S. Patent No. 6,750,453) (Nelson) in view of Griggs et al. (U.S. Patent No. 4,520,265) (Griggs). This rejection gives rise to the following issue:

Issue 1 – Whether Claims 1, 2, 5, 7, 11, 12, 13, 15, and 16 are unpatentable under 35 U.S.C. § 103(a) over Nelson in view of Grigg.

Claims 3 and 8 currently stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson in view of Hodgkinson (International Publication No. WO 01/94916). This rejection is dealt with, in part, in the discussion of Issue 1, and also gives rise to the following issue:

Issue 2 – Whether Claims 3 and 8 are unpatentable under 35 U.S.C. § 103(a) over Nelson in view of Hodgkinson.

Claims 4 and 9 currently stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson in view of subject matter alleged to be old and well known. This rejection is dealt with, in part, in the discussion of Issue 1, and also gives rise to the following issue:

Issue 3 – Whether Claims 4 and 9 are unpatentable under 35 U.S.C. § 103(a) over Nelson in view of what is old or well known.

Claims 6, 10, 14, 18, 20, 24 and 25 currently stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson in view of French (U.S. Patent No. 4,676,642). With respect to Claims 6, 10, and 14, this rejection is dealt with in the discussion of Issue 1, and further gives rise to the following issue for each of Claims 6, 10, 14, 18, 20 and 24:

Issue 4 – Whether Claims 6, 10, 14, 18, 20, 24 and 25 are unpatentable under 35 U.S.C. § 103(a) over Nelson in view of French.

Claim 17 currently stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson in view of Smith et al. (U.S. Patent No. 6,756,592) (Smith). This rejection is dealt with in the discussion of Issue 1.

Claims 21, 22 and 23 currently stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Nelson in view of French and Hodgkinson. This rejection is dealt with in the discussion of Issue 4.

Claim 1 currently stands rejected under 35 U.S.C. § 102(b) as being anticipated by Zwick (U.S. Patent No. 4,543,481). This rejection gives rise to the following issue:

Issue 5 – Whether Claim 1 is anticipated under 35 U.S.C. § 102(b) by Zwick.

Claim 2 currently stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Zwick and Griggs in view of Hodgkinson. This rejection gives rise to the following issue:

Issue 6 – Whether Claim 2 is unpatentable under 35 U.S.C. § 103(a) over Zwick and Griggs in view of Hodgkinson.

VII. ARGUMENT

Under 35 U.S.C. § 103(a), a rejection of the claims generally must meet four key elements as set out by the Supreme Court in *Graham v. John Deere*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966), and recently reaffirmed in *KSR International Co. v. Teleflex Inc. (KSR)*, 550 U.S. ___, 82 U.S.P.Q.2d 1385 (2007). These elements are summarized in the *Manual of Patent Examining Procedure (MPEP) Edition 8 (E8), August 2001, Latest Revision September 2007*, s. 2141, as follows:

- (A) Determining the scope and contents of the prior art;
- (B) Ascertaining the differences between the prior art and the claims in issue;
- (C) Resolving the level of ordinary skill in the pertinent art; and
- (D) Evaluating evidence of secondary considerations.

Appellants submit that the Examiner has failed to correctly determine the scope and contents of the prior art and also to properly assess the differences between the references and the claimed invention.

Appellants also submit that the Examiner has failed to recognize that Griggs teaches away from the claimed invention, and has failed to show what would have led an ordinary artisan to the claimed invention.

In *Takeda Chemical Ind., Ltd. v. Alphapharm Pty., Ltd.*, 417 F. Supp. 2d 341 (S.D.N.Y. 2006), aff'd on appeal, 492 F.3d 1350 (Fed. Cir. 2007), it was held that a prior art reference teaches away from a claim "when it suggests that the developments flowing from its disclosures are unlikely to produce the objective of the applicant's invention." Where a deviation in a reference tends to teach away from a claim, "the challenger must show what would have led any ordinary artisan in the field to follow the precise steps that produced a remarkable invention."

Issue 1 – Whether Claims 1, 2, 5, 7, 11, 12, 13, 15, and 16 are unpatentable under 35 U.S.C. § 103(a) over Nelson in view of Griggs

Claim 1 refers to "detecting the presence of ethane by detecting variations in solar radiation reflected from the target area." The Examiner distinguished Nelson from Claim 1 as not teaching this element. Instead, Nelson provides his own light source as a source of radiation to be detected. The Examiner cites Griggs as teaching detecting solar radiation in, for example, Col. 2, lines 28-46, and concludes that it would be obvious to modify Nelson as taught by Griggs.

The Examiner has misunderstood Griggs and further has failed to recognize that Griggs teaches away from detecting the presence of ethane by detecting variations in solar radiation reflected from the target area. Instead, Griggs teaches a device that is unaffected by reflected solar radiation and seeks to reduce the impact of reflected solar radiation. For example, Griggs states at Col. 1, lines 49 to 51: "It is another object of this invention to provided RGFC apparatus which is *blind* to reflected solar radiation" (emphasis added). In the abstract, Griggs teaches an apparatus that "permits highly accurate remote measurements of methane gas concentrations *even in daylight*" (emphasis added), implying that the preferable working conditions are in the absence of daylight. At Col. 1, lines 58 to 60: "Stated succinctly, in this invention the effect of reflected sunlight is made negligible by using an extremely narrow spectral filter" At Col. 3, lines 25-31, Griggs explains that "the ambient methane and water vapor significantly attenuate the incoming solar radiation so that . . . the GFC sensor 10 according to this invention is 'quasi-solar-blind.'" Griggs goes on to explain that this means that the sensor 10 "will not be affected by varying solar illumination, and will give the same output day and night." Clearly, Griggs does not teach the use of reflected solar radiation to detect the presence of gas.

What Griggs teaches in the portion cited by the Examiner at Col. 2, lines 28-46, is not that one should use solar radiation to aid in the sensing of gas, but rather that solar radiation is one of the components in the measured signal. Griggs cannot "detect variations in solar radiation," as this component is filtered from the measured signal rather than quantified. Griggs thus teaches an apparatus which eliminates unwanted solar radiation rather than making a measurement using solar radiation, the complete opposite of what is claimed. Thus, in light of

Griggs, a skilled artisan would not seek to enhance the solar radiation component of a detection system, but would seek to remove it. Therefore, the appellants submit that Claim 1 is patentable over the combination of Nelson and Griggs.

As Claims 2–16 depend directly or indirectly on Claim 1, it is believed that they are also patentable over Nelson in view of Griggs. The Examiner also rejected Claim 26; however this claim had been canceled in a previous amendment. Some of Claims 2-16 were also rejected based on Nelson in view of Hodgkinson, French, and subject matter alleged to be old and well known, which appellants deny. However, none of these references make up the deficiencies identified above as they do not teach the use of reflected solar radiation to detect ethane.

Issue 2 – Whether Claims 3 and 8 are unpatentable under 35 U.S.C. § 103(a) over Nelson in view of Hodgkinson.

This issue relates specifically to the rejection of Claims 3 and 8 based on Nelson in view of Hodgkinson. Since these claims depend from Claim 1, appellants have treated the rejection as if it were based on Nelson and Griggs in view Hodgkinson. In addition to the arguments related to Issue 1 discussed above, the following arguments apply to these claims.

The Examiner recognized that Nelson does not disclose the claimed bandwidth of 2850-2975 cm^{-1} , but recited Hodgkinson as disclosing this bandwidth in his Fig. 2. Although Fig. 2 shows a much wider band for ethane than is known in the Hitran database, what Hodgkinson does not show is whether this band has any fine-scale structure (absorption lines). Hodgkinson shows a very low resolution scan of the C_2H_6 band at 3000 cm^{-1} with very little information as to what the figure represents or how the measurements were made. As a consequence it is almost impossible to tell whether the absorption feature represents anything new above the Hitran data, and impossible to tell whether the absorption feature contains any new absorption lines.

For the GFCR technique to work, it requires that the gas being measured has fine-scale (spectral) line structure as disclosed in Fig. 3 of the present application. In other words, the individual absorptions lines have to be distinct under typical measurement pressures and

temperatures. The GFCR technique uses a sample of the gas of interest as a "spectral filter" to select wavelengths over a wide pass-band where the gas of interest absorbs. In other words, to first order, a GFCR measures the gas of interest only at wavelengths where the gas has absorption line. This provides two distinct and very important advantages. First, by selecting only wavelength where absorption of the gas is located, sensitivity to that gas is significantly increased. Second, by selecting only wavelengths where the gas of interest absorbs, it reduces the interference of other gases which may have absorption lines in the same spectral region. Since most of the absorption lines of the interfering gases will not overlap the lines of the gas of interest, sensitivity to interference by other gases is minimized.

If a GFCR is used to detect a gas in which the absorption band does not contain any fine structure (as is shown in Hodgkinson), the GFCR will have very little selectivity for the gas of interest. Any interfering gases (gases with absorption lines within the band such as water) will interfere substantially with the measurement, producing erroneous signals. For ethane, it is not immediately clear that fine-structure in the band should exist, and Hodgkinson's data does not suggest it does. All that can be said from the Hodgkinson patent is that there seems to be a larger than expected broad absorption feature in ethane at 3.35 μm from a spectral measurement of an unknown spectral resolution of an unknown quantity of ethane. This figure does little to suggest that this absorption feature might make a good spectral band for measuring C_2H_6 with a GFCR.

Consequently, it is submitted that Claims 3 and 8 are patentable over the cited references.

Issue 3 – Whether Claims 4 and 9 are unpatentable under 35 U.S.C. § 103(a) over Nelson in view of what is old or well known.

This issue relates specifically to the rejection of Claims 4 and 9 based on Nelson and what is old or well known. Since these claims depend from Claim 1, appellants have treated the rejection as if it were based on Nelson and Griggs in view Hodgkinson. In addition to the arguments related to Issue 1 discussed above, the following arguments apply to these claims.

The Examiner stated that "any specific band would have been an obvious matter of design choice," and that "a wideband would lead to increased sensitivity by increasing the captured

signals." This position is incorrect. Various factors dealt with above in relation to the Hodgkinson reference make the selection of the band more than routine skill, and merely providing a wider band would not necessarily increase the sensitivity, as it would also increase the noise, and there would be the risk of multiple signals interfering with each other. A specific absorption peak of a target gas must provide adequate absorption bands, as well as not include interfering bands of other absorbers, and provide a sufficiently strong signal over background that the signal is detectable. Instead of providing a wider band, detection systems generally try to narrow the band to look specifically where results will be expected.

Consequently, it is submitted that Claims 4 and 9 are patentable over the cited references.

Issue 4 – Whether Claims 6, 10, 14, 18, 20, 24 and 25 are unpatentable under 35 U.S.C. § 103(a) over Nelson in view of French

This issue relates specifically to the rejection of Claims 6, 10, 14, 18, 20, 24 and 25, which were rejected based on Nelson in view of French.

Since Claims 6, 10 and 14 depend from Claim 1, appellants believe the Examiner also intended to include Griggs in the rejection of those claims. With respect to Claims 6, 10 and 14, the above arguments related to Issue 1 apply. With respect to Claims 18, 20, 24 and 25, the following arguments apply.

The Examiner has noted that Nelson does not teach the use of a bi-prism. The Examiner cited French as teaching a bi-prism used as a beam splitter. However, the conventional Fresnel bi-prism described in French or Fateley (also cited by the Examiner) is formed of two wedges joined at their thicker sides to create an isosceles shape. A beam incident on a Fresnel bi-prism converges after passing through the bi-prism.

The presently claimed bi-prism (see Fig. 2 for an example) causes light passing through the bi-prism to diverge into two paths, as claimed in Claim 18. In Claim 18, the following language clearly shows that the currently claimed bi-prism is not a conventional converging bi-prism:

Claim 18: "a bi-prism beam splitter mounted in the housing as part of the optics for directing radiation entering the window from an outside source along

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CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

two divergent paths offset from each other through the bi-prism to divide the radiation between the first optical path and the second optical path."

The cited bi-prisms of French and Fateley do not direct "radiation entering the window from an outside source along two divergent paths offset from each other" and do not "divide the radiation between the first optical path and the second optical path." Rather, the device of French does not cause the light through the prism to diverge as claimed in Claim 18, but instead causes it to converge to produce an interference pattern. The interference pattern is used for detection. Hence, the combination of the references fails to yield the invention as claimed in Claims 18, 20, 24 and 25.

In the art, it is common to use a partially reflective mirror to achieve separation of light beams. In the claimed bi-prism, light is not partitioned using a reflected component nor caused to converge, but instead is partitioned using the transmitted components of two portions of a bi-prism. As shown in Fig. 2 of the present disclosure the energy passing through the system is partitioned biaxially. Energy passing through each half of the optical chain is imaged offset from each other. The distance between the images is a function of the angle of the prisms. This technique minimizes polarization problems, partly due to the fact that the angles of the prism surfaces relative to the optical axis are small. Hence, Claims 18, 20, 24, and 25 are patentable over the cited art.

The Examiner, in his response to appellants' argument, also cites Fateley, U.S. Patent No. 4,750,834, to reject Claims 18 and 21. However, as with French, the recited prism of Fateley is used to generate convergent beams that interfere with each other, rather than two separate signals that follow separate paths. Hence, the disclosure of Fateley is not relevant.

Issue 5 – Whether Claim 1 is anticipated under 35 U.S.C. § 102(b) by Zwick.

As indicated in the appellants' response filed February 21, 2007, the rejection of Claim 1 based on Zwick as recited by the Examiner is difficult to understand. The Examiner first recites 35 U.S.C. § 102(b) and rejects Claim 1 as being anticipated by Zwick, but then recites a missing teaching, namely, failing to disclose detecting variations in solar radiation, and cites Griggs. If the Examiner intended an anticipation rejection under Section 102, the Examiner has also shown

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

in his arguments how Claim 1 is not anticipated by Zwick. If the Examiner intended an obviousness rejection under Section 103, Griggs teaches away from the approach claimed in Claim 1 as discussed above under Issue 1.

The Examiner recognized that Zwick does not disclose detecting variations in solar radiation. As such, Zwick does not teach every element, and therefore does not anticipate Claim 1. Furthermore, as discussed under Issue 1, Griggs teaches away from detecting variations in solar radiation, and therefore the combination of Zwick and Griggs cannot yield the claimed invention.

Issue 6 – Whether Claim 2 is unpatentable under 35 U.S.C. § 103(a) over Zwick and Griggs in view of Hodgkinson.

None of Zwick, Griggs and Hodgkinson teach the use of reflected sunlight to detect the presence of ethane, and the combination does not make up this deficiency. Claim 2 is therefore patentable over the cited references.

VIII. CONCLUSION

In light of the above arguments, appellants submit that:

- Claims 1, 2, 5, 7, 11, 12, 13, 15 and 16 are patentable over Nelson in view of Griggs;
- Claims 3 and 8 are patentable over Nelson in view of Hodgkinson;
- Claims 4 and 9 are patentable over Nelson in view of what is old and well known;
- Claims 6, 10, 14, 18, 20, 24 and 25 are patentable over Nelson in view of French
- Claim 17 is patentable over Nelson in view of Smith;
- Claims 21, 22 and 23 are patentable over Nelson in view of French and Hodgkinson;
- Claim 1 is not anticipated by Zwick; and
- Claim 2 is patentable over Zwick and Griggs in view of Hodgkinson.

The Board is requested to reverse the claim rejections and remand the case to the Primary Examiner for allowance.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

IX. CLAIMS APPENDIX

1. (Previously presented) A method of detecting gas leaks, the method comprising the steps of:

traversing a target area with a gas filter correlation radiometer having a field of view oriented towards the target area, the gas filter correlation radiometer being tuned to detect ethane; and

identifying a gas leak upon the gas filter correlation radiometer detecting the presence of ethane by detecting variations in solar radiation reflected from the target area.

2. (Original) The method of claim 1 in which the gas filter correlation radiometer is tuned to detect ethane using an ethane absorption peak at 3000 cm^{-1} .

3. (Previously presented) The method of claim 1 in which the gas filter correlation radiometer is tuned to detect ethane using an ethane absorption peak at a bandwidth of 2850 to 3075 cm^{-1} .

4. (Original) The method of claim 1 in which the gas filter correlation radiometer is tuned to detect ethane using an ethane absorption peak at a bandwidth up to 150 cm^{-1} above or below 3000 cm^{-1} .

5. (Original) The method of claim 1 in which the gas filter correlation radiometer comprises:

a window in a housing;

optics defining a first optical path and a second optical path between the window and a detector section mounted in the housing;

a beam splitter mounted in the housing as part of the optics for directing radiation entering the window from an outside source to divide the radiation between the first optical path and the second optical path;

the first optical path having a first ethane path length and the second optical path having a second ethane path length, the first ethane path length being different from the second ethane path length; and

electronics for processing signals produced by the detector section as a result of radiation being directed by the optics onto the detector section.

6. (Original) The method of claim 5 in which the beam splitter comprises a bi-prism.
7. (Original) The method of claim 5 in which the gas filter correlation radiometer is tuned to detect ethane using an ethane absorption peak at 3000 cm^{-1} .
8. (Original) The method of claim 5 in which the gas filter correlation radiometer is tuned to detect ethane using an ethane absorption peak at a bandwidth of 2850 to 3075 cm^{-1} .
9. (Original) The method of claim 5 in which the gas filter correlation radiometer is tuned to detect ethane using an ethane absorption peak at a bandwidth up to 150 cm^{-1} above or below 3000 cm^{-1} .
10. (Original) The method of claim 6 in which the gas filter correlation radiometer is tuned to detect ethane using the ethane absorption peak at 3000 cm^{-1} by incorporating a filter in the optics that selects radiation in a passband that includes the ethane absorption peak at 3000 cm^{-1} .
11. (Original) The method of claim 5 in which the first optical path is provided with an ethane path length by incorporation into the first optical path of a gas filter containing ethane.

12. (Original) The method of claim 11 in which the second ethane path length is lower than the first ethane path length.

13. (Original) The method of claim 5 in which the detector section further comprises:
a first detector on the first optical path and a second detector on the second optical path, and corresponding pixels on the first detector and second detector having collocated fields of view and being sampled synchronously.

14. (Previously presented) The method of claim 5 in which the detector section detects radiation using a pushbroom imaging technique, in which pixels in an array of pixels in the detector section are sampled simultaneously.

15. (Original) The method of claim 1 in which the gas filter correlation radiometer is mounted in an aircraft.

16. (Previously presented) The method of claim 1 in which the gas leak is located along a pipeline, and detection of the gas leak is carried out only using detection of ethane.

17. (Original) The method of claim 1 in which the gas leak is detected as part of a reservoir mapping process.

18. (Previously presented) A gas filter correlation radiometer, comprising:
a window in a housing;
optics defining a first optical path and a second optical path between the window and a detector section mounted in the housing;
a bi-prism beam splitter mounted in the housing as part of the optics for directing radiation entering the window from an outside source along two divergent paths offset from each

other through the bi-prism to divide the radiation between the first optical path and the second optical path;

the first optical path having a first gas path length and the second optical path having a second gas path length, the first gas path length being different from the second gas path length; and

electronics for processing signals produced by the detector section as a result of radiation being directed by the optics onto the detector section.

19. (Canceled)

20. (Original) The gas filter correlation radiometer of claim 18 in which the gas filter correlation radiometer is tuned to detect ethane using the ethane absorption peak at 3000 cm^{-1} .

21. (Previously presented) A gas filter correlation radiometer, comprising:

a window in a housing;

optics defining a first optical path and a second optical path between the window and a detector section mounted in the housing;

a beam splitter mounted in the housing as part of the optics for directing radiation entering the window from an outside source to divide the radiation between the first optical path and the second optical path;

the first optical path having a first gas path length and the second optical path having a second gas path length, the first gas path length being different from the second gas path length; and

electronics for processing signals produced by the detector section as a result of radiation being directed by the optics onto the detector section, the gas filter correlation radiometer being tuned to detect ethane using an ethane absorption peak at a bandwidth of at least 2850 to 3075 cm^{-1} .

22. (Previously presented) The gas filter correlation radiometer of claim 21 in which the gas filter correlation radiometer is tuned to detect ethane using an ethane absorption peak at a bandwidth up to 150 cm^{-1} above or below 3000 cm^{-1} .

23. (Previously presented) The gas filter correlation radiometer of claim 21 in which the gas filter correlation radiometer is tuned to detect ethane using the ethane absorption peak at 2850 to 3075 cm^{-1} by incorporating a filter in the optics that selects radiation in a passband that includes the ethane absorption peak at 2850 to 3075 cm^{-1} .

24. (Original) The gas filter correlation radiometer of claim 18 in which the first optical path incorporates a gas filter containing ethane.

25. (Original) The gas filter correlation radiometer of claim 24 in which the second gas path length is lower than the first gas path length.

26-31. (Canceled)

X. EVIDENCE APPENDIX

None.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

XI. RELATED PROCEEDINGS APPENDIX

None.

Respectfully submitted,

CHRISTENSEN O'CONNOR
JOHNSON KINDNESS^{PLLC}

A handwritten signature in black ink, appearing to read "Kevan L. Morgan". The signature is fluid and cursive, with the first name "Kevan" and last name "Morgan" being clearly distinguishable.

Kevan L. Morgan
Registration No. 42,015
Direct Dial No. 206.695.1712

KLM:jlb

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS^{PLLC}
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100